Original Article ISSN (O):2395-2822; ISSN (P):2395-2814

A Radiology - Pathological Correlation Of Intracranial Meningioma in a Tertiary Care Hospital-A Retrospective Study.

P. Kannan[1], A. G. Krishnaveni[2], Heber Anandan[3]

[1]Professor and Head, Department of Pathology, Thoothukudi Medical College, Tamilnadu, India
[2]Associate Professor, Department of Pathology, Thoothukudi Medical College, Tamilnadu, India
[3]Senior Clinical Scientist, Department of Clinical Research, Dr.Agarwal's Healthcare Limited, Tamilnadu, India.

Received: June 2017
Accepted: June 2017

ABSTRACT

Background: The study was conducted to understand the clinical algorithm of intracranial meningioma. Correlation was done by clinical presentation with radiological features and histopathology .The stress upon to understand the necessity for a team-approach between Clinician, Radiologist and Pathologist and vice versa is emphasised. Aim: To correlate histopathology of intracranial brain tumours with the Radiological features. **Methods:** This is a retrospective study ofintracranial brain tumours, diagnosed by histopathology as various types of meningioma. All the relevant clinical data of the patients were searched from the ward records. The various Radiological features were collected. **Results:** The total number of intracranial brain tumours studied at during the 5 years period was 51 cases among which 25 cases were diagnosed by histopathology as various types of meningioma conclusively . Spectroscopy provides molecular information with regard to meningiomas and potentially aid in biopsy planning. Surgical resections were done as follows: 17 cases resected as Simpson Grade 1, 3 cases resected as Simpson Grade 2, and 2 cases resected as Simpson grade 3. Venous thromboembolism was seen in 1 patient . Seven patients underwent Stereotactic radiosurgery, among which four patients attended SRS after surgery. **Conclusion:** The Simpsongrading of resection of meningioma correlated the degree of surgical resection completeness with symptomatic recurrence. Stereotactic radiosurgery is a safe and effective treatment for benign intracranial meningiomas with or without surgical resection. Intracranial meningioma needs correlation between Radiologist, Pathologist and Clinician.

Keywords: Radiograph, CT, MRI, Angiogram, H&E Stain, Simpson grading of resection, stereotactic radiosurgery.

INTRODUCTION

Meningiomas, which arise from arachnoid cap (meningothelial) cells, are one of the most frequently encountered intracranial tumours accounting for 20–36% of all primary tumours with an annual incidence rate of up to 1.8–13 per 100,000 population.[1-4] The incidence of meningioma is due to exposure to environmental risk factors or sensitive diagnostic modalities , there is a relationship between age, sex, pathological subtype and location of meningioma.[5] An estimated 2–3% of the population has an incidental asymptomatic meningioma in autopsy studies.[6] With the wider use of CT and MRI, many meningiomas are discovered as incidental findings during investigation for unrelated symptoms.[7] Sex, age, initial tumour size, and calcification were reported to be related to the tumour growth judging from follow-up scans.[8] Extra-axial meningioma denotes lesions that are external to the brain parenchyma, in contrast to intra-axialmeningioma which describes lesions within the brain substance. Meningiomas are categorized into three World Health Organization (WHO) grades with 16 histological subtypes. Peritumoral brain edema (PTBE) is frequently observed in cases of microcystic, secretory, or angiomatous meningiomas.[9] Mast cells are numerous in some microcystic, secretory, and angiomatous meningiomas.[10] Data from atomic bomb survivors demonstrated a significantly elevated incidence of meningiomas compared to a nonexposed population with a relative risk of meningioma.[11,12] Meningiomas are more commonly diagnosed in women at a ratio of but atypical and anaplastic meningiomas occur more predominantly in men . Meningiomas are closely associated with the tumour suppressor syndrome NF2, with 50–75% of individuals with NF2 developing a meningioma during their lifetime.[13] Meningiomas are the most common extra-axial primary brain tumour.[14] Although a majority of these tumours are low grade, a significant proportion will recur after initial treatment.[15] Literature published since the WHO 2000 classification report higher recurrence rates at five years following surgical excision for WHO grade II (41%),[16] and 70–91%)for gradeIII (than for

WHO grade I lesions (3%) . The loss of tumour-brain interface, presence of oedema, irregular tumour shape, heterogeneous enhancement on MRI, decreased apparent diffusion coefficient (ADC) in diffusion weighted imaging (DWI) predicts the aggressive histological and clinical behaviour of meningioma.[17,18]

Name & Address of Corresponding Author
Dr A.G. Krishnaveni
Associate Professor of Pathology,
Thoothukudi Medical College,
Thoothukudi, Tamilnadu, India

AIM

To correlate histopathology of intracranial brain tumours with the Radiological features.

MATERIALS AND METHODS

This retrospective study was conducted in Department of Pathology, Thoothukudi Medical College Hospital. We reported 51 cases of primary brain tumours among which 25 cases were various types of meningioma by histopathology conclusively. All the relevant clinical data of the patients were searched from the ward records. Parameters used to assess were age, sex, tumour location, pathological subtype, Simpson grade of surgical excision, tumour recurrence or progression during follow-up, VTE in the follow-up period, SRS during follow-up and survival time. A detailed health profile on general condition was taken and recorded.

RESULTS

Meningioma commonly involved convexity region and parasagittal regions in the study. Meningothelial meningioma and transitional meningioma were the common subtypes observed. [Table 1]

Table 1: Distribution of Tumour Locations and Histopathological Subtypes of Intracranial Meningioma

Location	Meningothelial	Fibrous	Transitional	Angiomatous	Atypical	Anaplastic	Total
Parasagittal	2	1	1	0	1	0	5
Convexity	7	2	4	1	2	1	17
Posterior fossa	1			1			2
Olfactory groove/ frontobasal	0	0	0	0	0	1	1
Total	10	3	5	2	3	2	25

T1weighted MRI Scan shows meningioma as a isointense lesion , contrast enhanced T1weighted scan shows enhancement of the lesion and T2 weighted scan shows meningioma as a high signal intensity lesion. The histopathological finding varies with the grades. [Table 2]

Table 2: Correlation study of Intracranial Meningioma

Tumour	Radiographic Findings	Histopathological Findings
Meningothelial meningioma	MRI demonstrates a vividly enhancing extra-axial mass posterior to the internal acoustic meatus. It is isointense to adjacent cerebellum on both T1 and T2 weighted images.	Sections studied show lobular microarchitecture, with spindly-looking cells with pink cytoplasm run in short fascicles, forming syncytial structures and whorls .
Fibroblastic meningioma	MRI Scan shows axial T1weighted shows a right parasagittal isointense mass . The focal low intensity is consistent with calcification .	Sections studied show being variably collagenized and consisting of spindle shaped tumour cells in interfascicular pattern .
Transitional meningioma	Post-contrast axialT1-weighted MRI image shows a parietal extra-axial mass showing strong enhancement with contrast administration .	Sections studied show meningothelial cells with fibroblastic appearance on the right and forming syncytial structures on the left. Abundant pink cytoplasm, indistinguishable cell membranes and bland nuclear features can be readily noted .
Angiomatous meningioma	DWI MRI Scan shows Hypointense and no restriction with the voids of blood vessels in the cerebellopontine angle	Section studied shows clear regions of classical meningothelial meningioma and vascular channels are prominent , the remaining meningioma cells show pleomorphism . The vascular channels are medium sized and have hyalinised thickened walls .
Atypical meningioma	A left frontal parafalcine mass is present with vivid albeit somewhat heterogeneous contrast enhancement. ADC demonstrates fairly low values, similar to brain parenchyma .	Section studied shows multifocal , centrilobular forms of necrosis . The multifocal necrosis may occur within hypercellular regions , creating a low power microscopic impression similar to the pseudopalisading of tumour cells around necrosis .
Anaplastic meningioma	MRI with contrast demonstrates a very large bifrontal extraaxial mass which has a large dural base and enhances homogenously . The frontal bone , especially on the left demonstrates abnormal signal with a small amount of extension beneath the scalp .	Section studied shows patternless sheet like growth , a large number of mitoses , increased cellularity, pleomorphism and anaplasia .

Meningioma

Meningiomas occur most commonly after the fifth decade of life. Females are affected far more commonly than males. The gross appearence of the typical meningioma is a solid, lobulated, or globose mass broadly attached to the duramater. On sectioning, most meningiomas are grayish-tan and soft, but collagenized, have a rubbery texture and a whorled or trabeculated cut surface, whereas variants rich in stromal mucopolysaccharides acquire a somewhat gelatinous consistency. Calcification is often readily apparent and infiltration by foamy macrophages reflect the accumulation of lipids within tumour cells. Benign meningiomas of WHO grade I can invade the dura, dural sinuses, skull, and even extracranial compartments, such as orbit, soft tissue, and skin. Factors that may influence the aetiology of peritumoral edema include tumour size, histological subtypes, vascularity, venous stasis, and brain invasion. Loss of chromosome 22 occurs in recurrent and atypical meningiomas. Approximately half of meningiomas exhibit allelic loss that involves band q12 on chromosome.[22]

The NF2 gene that resides in this region on chromosome 22q is a tumour suppressor gene involved in sporadic and NF2- associated meningioma tumourigenesis . Mutations in NF2 gene is associated with sporadic meningioma, fibrous meningioma, transitional meningioma, meningothelial meningioma, atypical and anaplastic meningiomas .

Behaviour is coded /0 for benign tumours, /1 for low or uncertain malignant potential or borderline malignancy, /2 for in situ lesions, and /3 for malignant tumours. [Table 3]

Table 3: Morphology code of the International Classification of Diseases for Oncology (ICD-O) of Intracranial Meningioma

Disease	Code
Meningothelial meningioma	9531/0
Fibrous (fibroblastic) meningioma	9532/0
Transitional (mixed) meningioma	9537/0
Psammomatous meningioma	9533/0
Angiomatous meningioma	9534/0
Microcystic meningioma	9530/0
Secretory meningioma	9530/0
Lymphoplasmacyte-rich meningioma	9530/0
Metaplastic meningioma	9530/0
Clear cell meningioma	9538/1
Chordoid meningioma	9538/1
Atypical meningioma	9539/1
Papillary meningioma	9538/3
Rhabdoid meningioma	9538/3
Anaplastic meningioma	9530/3

Treatment for intracranial meningioma

Embolization: The middle meningeal artery is frequently used as a pathway for endovascular embolization for meningioma. Embolization involves the devascularisation of a tumour's blood supply through the placement of an embolic agent via a microcatheter into the feeding arteries. After the microcatheter has been properly and safely positioned, embolic material is injected under constant, real-time digital-subtraction fluoroscopy, to allow penetration of the material into the tumour bed, thereby producing devascularisation and subsequent necrosis .In general, particulate agent's polyvinyl alcohol particles and acrylic microspheres are favoured because of their relative ease of use. A delay of 7 to 10 days following embolization to allow tumour necrosis to occur and to simplify resection.

Surgery for intracranial meningioma: If the tumour is located close to the surface of the brain near the skull a convexity meningioma, surgery is a more straightforward procedure. For meningiomas located deeper in the brain, the surgeon may need to move the brain tissue aside. Remove as much of the meningioma as possible without affecting nearby healthy tissue. Once the tumour has been sufficiently removed, the skull opening will be closed by replacing and reattaching the bone flap and the scalp incision is sutured. Another challenging presentation is a skull base meningioma that grows near the foramen magnum, the large opening at the bottom of the skull where it intersects with the spinal column. Several critical blood vessels and nerves sit at the base of the skull. It is often important to have a multidisciplinary team care for these types of tumours. Surgically, the presence of PTE might indicate a more difficult tumour resection, aggressive meningioma and disruption of arachnoid layer at the tumour brain-interface. PTE on the MRI, however, has been attributed to several other factors including tumour size, location, histological grading, tumour vascularity, and tumour-related venous obstruction, impairment of blood - brain barrier, presence of pial-cortical blood supply, vascular endothelial growth factor and irregular tumour margin.

The Simpson grade of meningioma resection was described in 1957 and correlated the degree of surgical resection completeness with symptomatic recurrence. The type of resection still plays a part in the likelihood of symptomatic recurrence, other factors (such as the MIB-1 index) are also important, particularly in grades I - III . [Table 4]

Table 4: The Simpson grade of meningioma resection

Simpson grade	Definition	10-Year recurrence rate
1	Macroscopic gross-total resection with excision of dura , sinus ,and bone .	9%
2	Macroscopic gross-total resection with coagulation of dural attachment.	19%
3	Macroscopic resection without resection or coagulation of dural attachment.	29%
4	Subtotal resection.	40%
5	Biopsy.	Not available

Stereotactic radiosurgery: Stereotactic radiosurgery is a safe and effective treatment for benign intracranial meningiomas with or without surgical resection. Single fraction stereotactic radiosurgery (SRS) (12–18 Gy) as a primary treatment for well selected, small meningiomas or as adjuvant treatment for residual disease .Radiation was delivered using the CyberKnife, a frameless robotic image-guided radiosurgery system with a median total dose of 25 Gy (range, 25–35 Gy). The Cyber Knife is an image-guided, frameless, SRS platform. The frameless configuration allows for staged treatment, and it has been successfully utilized to treat meningioma's. MRI scans were obtained at pre-defined intervals, every 6 months for the first year, and then yearly thereafter, unless acute changes in neurological status warranted immediate imaging.

Chemotherapy for meningioma

Antiepileptic drugs should be started preoperatively in supratentorial surgery and continued postoperatively for no less than 3 months. Some studies have shown a possible role of COX-2 inhibitors in the treatment of recurrent meningiomas. Molecules to block specific growth factors or enzymes are being developed. Atypical meningioma (WHO grade II) and anaplastic meningioma (WHO grade III) showed increased fatty acid synthase (FAS) expression. FAS inhibitor (cerulein) decreased meningioma cell survival in vitro. Thus, increased FAS expression in human meningiomas represents a novel therapeutic target for the treatment of unresectable or malignant meningiomas.

Meningotheliomatous Meningioma

Ten cases of meningotheliomatous meningioma were reported . Six cases involving females and four involving males . The age group involved in females range from 56-74 years of age old and the age group involved in males range from 59-80 years of age old. Seven cases involved convexity , two involved parasagittal region and one case involved cerebellopontine angle . Seven cases underwent Simpson grade 1 resection and three cases underwent stereotactic radiosurgery as they were less than two centimetres in size. Microscopically meningotheliomatous meningioma variants are the classic and common variant characterized by a lobular microarchitecture and are populated by cells having delicate round or oval nuclei. Common to these are tumour cells concentrically wrapped in tight whorls, pale nuclear "pseudoinclusions" and nuclear 'washing out' consisting of invaginated cytoplasm, and the lamellated calcospherules known as psammoma bodies.

Sections studied show lobular microarchitecture, with spindly-looking cells with pink cytoplasm run in short fascicles, forming syncytial structures and whorls .T2 weighted MRI Scan shows high signal intensity with postcontrast administration in the cerebellopontine angle. MRI demonstrates a vividly enhancing extra-axial mass posterior to the internal acoustic meatus. It is isointense to adjacent cerebellum on both T1 and T2 weighted images. The seventh and eighth cranial nerves are clearly separate. The histopathology and radiology correlation was perfect in all the ten cases [Figure 1 and 2].

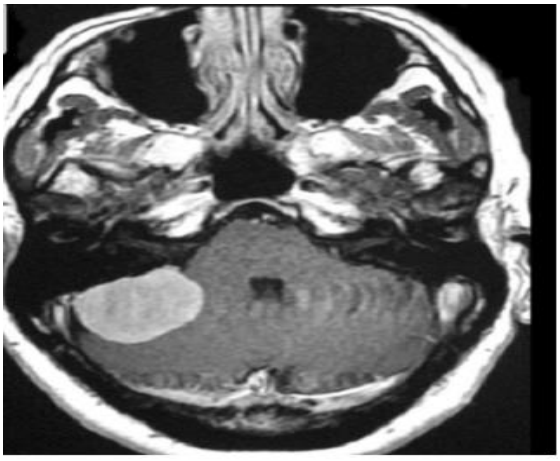

Figure 1: T2 weighted MRI Scan shows high signal intensity with postcontrast administration in the cerebellopontine angle.

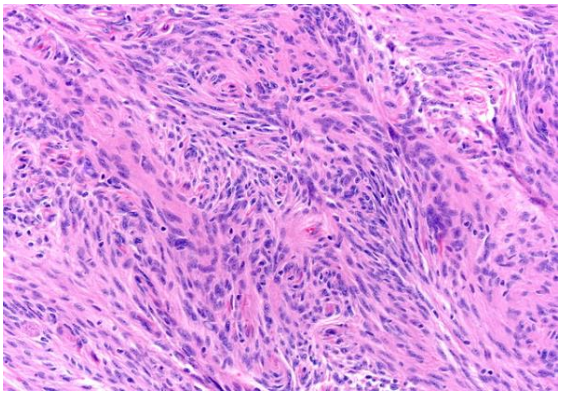

Figure 1: Sections studied show lobular microarchitecture, with spindly-looking cells with pink cytoplasm run in short fascicles, forming syncytial structures and whorls.

Fibroblastic Meningioma

Three cases of fibroblastic meningioma were reported. Two cases involving females and one involving males. The age group involved in females range from 52-67 years of age old and the age group involved in males range from 57-72 years of age old. Two cases involved convexity, one involved parasagittal region. All three cases underwent Simpson grade 1 resection .Fibroblastic meningioma is a common variant adopt a mesenchymal profile, being variably collagenized and consisting of spindle shaped tumour cells in interfascicular pattern. In fibroblastic meningioma the tumour cells

form wide fascicles, with intercellular collagen and reticulin . The collagenous bands may be quite broad and may undergo dense calcification.

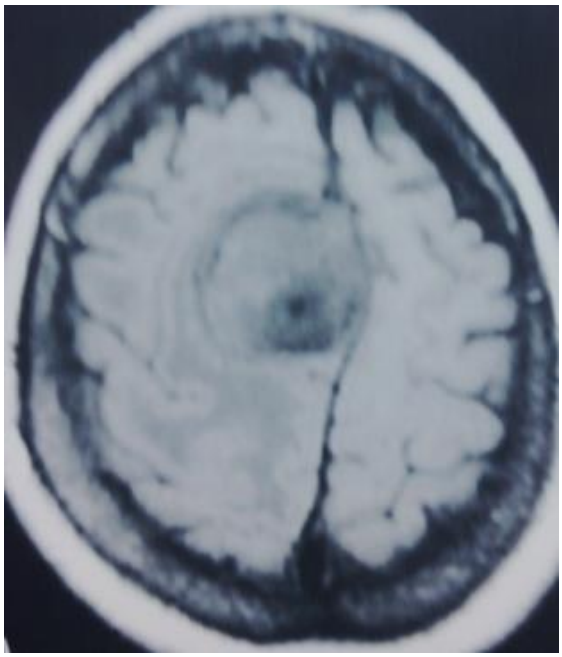

Figure 2: MRI Scan shows axial T1weighted shows a right parasagittal isointense mass. The focal low intensity is consistent with calcification.

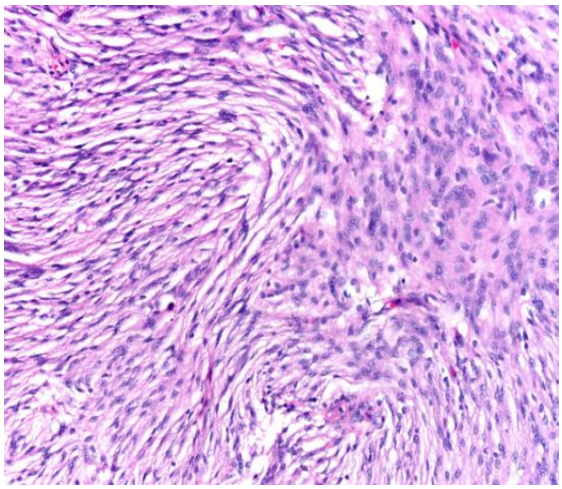

Figure 3: The focal low intensity is consistent with calcification. Sections studied show being variably collagenized and consisting of spindle shaped tumour cells in interfascicular pattern.

MRI Scan shows axial T1weighted shows a right parasagittal isointense mass. The focal low intensity is consistent with calcification. Sections studied show being variably collagenized and consisting of spindle shaped tumour cells in interfascicular pattern. The histopathology and radiology correlation was perfect in all the three cases. [Figure 3 & 4]

Transitional Meningioma

Five cases of fibroblastic meningioma were reported. Three cases involving females and two involving males. The age group involved in females range from 56-68 years of age old and the age group involved in males range from 54-67 years of age old. Four cases involved convexity, one involved parasagittal region. All five cases underwent Simpson grade 1 resection. Microscopically these tumours have transition between meningothelial and fibrous meningioma .They maintain a lobular and fascicular arrangement. Whorls are striking and are tightly wound. These are often particularly rich in compact cellular whorls and endowed with psammoma bodies in significant numbers. Some tumours have large, distinct areas of meningothelial , fibrous and transitional regions mingle locally

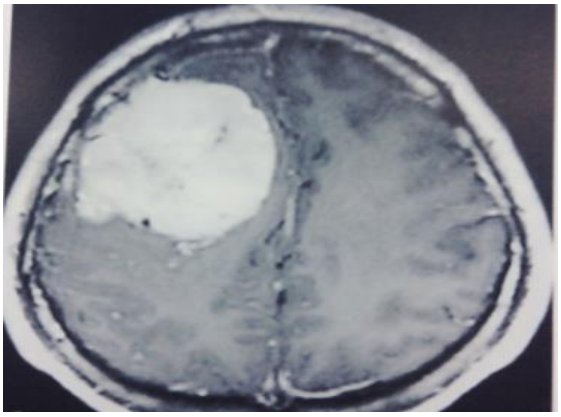

Figure 4: Post-contrast axialT1-weighted MRI image show a parietal extra-axial mass showing strong enhancement with contrast administration.

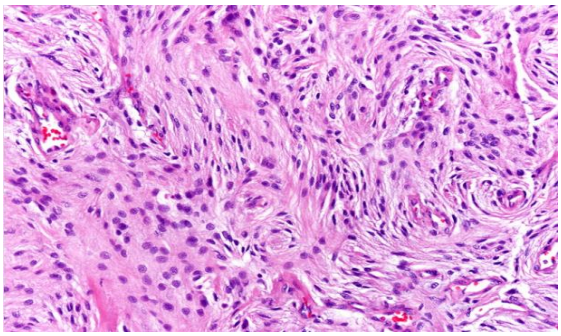

Figure 5: Sections studied show meningothelial cells with fibroblastic appearance on the right and forming syncytial structures on the left.

Post-contrast axialT1-weighted MRI image show a parietal extra-axial mass showing strong enhancement with contrast administration. Sections studied show meningothelial cells with fibroblastic appearance on the right and forming syncytial structures on the left. Abundant pink cytoplasm, indistinguishable cell membranes and bland nuclear features can be readily noted. The histopathology and radiology correlation was perfect in all the five cases. [Figure 5 & 6]

Angiomatous meningioma

Two cases of angiomatous meningioma were reported. One case involving female and one involving male. The age group involved in female is

62 years of age old and the age group involved in male 56 years of age old. One case involved convexity, one involved cerebellopontine angle. All two cases underwent Simpson grade 1 resection. One case underwent follow up stereotactic radiosurgery .Microscopically these tumours have numerous, conspicuous blood vessels with regions of classical meningothelial meningioma. The vascular channels may be small, medium sized and may be thin walled or have hyalinised thickened walls. DWI MRI Scan showshypointense and no restriction with the voids of blood vessels. The MRI characteristic is the presence of signal void pseudocapsule. The pseudocapsule consists of linear signal void representing the dura itself, interposed between the tumour and the brain parenchyma, as well as punctate foci of signal void owing to the displaced vessels. The presence of feeding artery as a signal void entering the tumour is also seen.

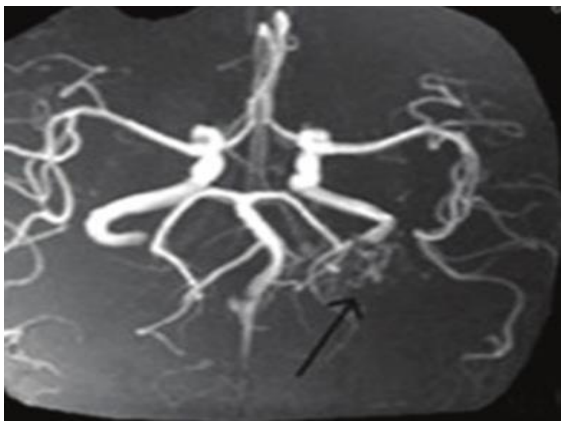

Figure 6: MRI Scan shows hypointense and no restriction with the voids of blood vessels in the cerebellopontine angle.

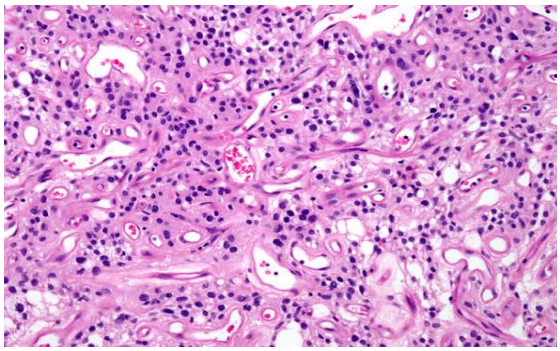

Figure 7: Section studied shows clear regions of classical meningothelial meningioma and vascular channels are prominent, the remaining meningioma cells show pleomorphism.

Section studied shows clear regions of classical meningothelial meningioma and vascular channels are prominent, the remaining meningioma cells show pleomorphism . The vascular channels are medium sized and have hyalinised thickened walls. DWI MRI Scan shows hypointense and no restriction with the voids of blood vessels in the cerebellopontine angle .The histopathology and radiology correlation was perfect in all the two cases. [Figure 7 & 8]

Atypical Meningioma

An atypical meningioma is more common in women of middle age or above 50 years of age. Microscopically atypical meningioma is characterised by multifocal, centrilobular forms of necrosis creating a low power microscopic impression similar to the pseudo palisading of tumour cells around necrosis. The absence of architectural pattern is referred to as 'sheeting'. Regions of hypercellularity and high nuclear: cytoplasmic ratio are seen in atypical meningioma. One finds irregular, small islands of dense cellularity with hyperchromatic nuclei and relatively inconspicuous cytoplasm otherwise called 'small cell formation' .The estimated recurrence rate for totally resected atypical meningiomas is about 40% at 5 years. Any of the following three criteria microscopically should be demonstrated for a diagnosis.

1. High mitotic index (e.g. ≥4 mitoses per 10 high power fields or ≥2.5/mm2)
2. Presence of at least three of the following four features:
    i. Sheeting architecture
    ii. Hypercellularity
    iii. Macro nucleoli
    iv. Small cell formation
3. Brain invasion

Three cases of atypical meningioma were reported. Two cases involving female and one involving male. The age group involved in female is 67 and 72 years of age old and the age group involved in male 56 years of age old . Two cases involved convexity, one involved left frontal parafalcine region. All three cases underwent Simpson grade 2 resection. One case underwent follow up stereotacticradiosurgery.

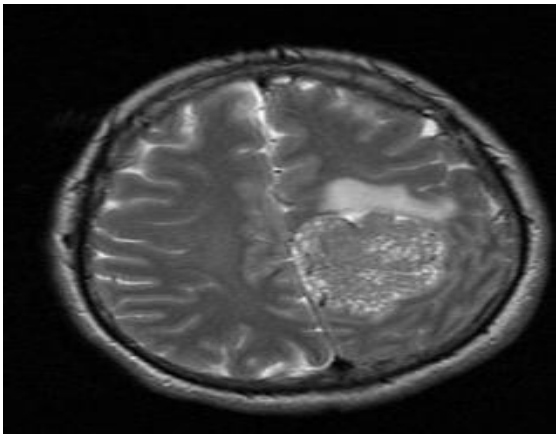

Figure 8: A left frontal parafalcine mass is present with vivid albeit somewhat heterogeneous contrast enhancement.

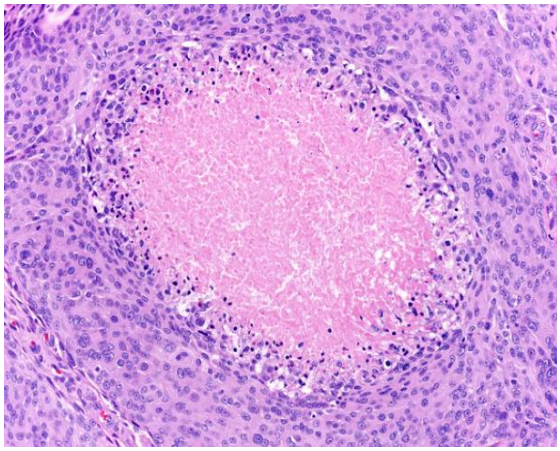

Figure 9: Section studied shows multifocal , centrilobular forms of necrosis . The multifocal necrosis may occur within hypercellular regions , creating a low power microscopic impression similar to the pseudopalisading of tumour cells around necrosis.

Section studied shows multifocal, centrilobular forms of necrosis. The multifocal necrosis may occur within hypercellular regions, creating a low power microscopic impression similar to the pseudopalisading of tumour cells around necrosis. A left frontal parafalcine mass is present with vivid albeit somewhat heterogeneous contrast enhancement. ADC demonstrates fairly low values, similar to brain parenchyma. The histopathology and radiology correlation was perfect in all the three cases. [Figure 9 & 10]

Anaplastic Meningioma

Anaplastic malignant meningioma microscopicallyshows patternless sheet like growth, a large number of mitoses, increased cellularity, focal necrosis , brain infiltration, pleomorphism and anaplasia . Anaplastic meningiomas are associated withrecurrence rates of up to 50–80% after surgical resection and median survival is less than 2 years. Two cases of anaplastic meningioma were reported. One case involving female and one involving male. The age group involved in female is 68 years of age old and the age group involved in male 66 years of age old . One case involved convexity, one involved bifrontal extraaxialregion . All two cases underwent Simpson grade 3 resection and one case underwent follow up stereotactic radiosurgery . One case died due to venous thromboembolism . MRI showed that the lesion had a slightly short T1 signal and a long T2 signal in addition to a conspicuous heterogeneous enhancement with contrast administration on T1-weighted images.

Section studied shows patternless sheet like growth, a large number of mitoses , increased cellularity, pleomorphism and anaplasia. MRI with contrast demonstrate a very large bifrontal extraaxial mass which has a large dural base and enhances homogenously. The frontal bone , especially on the left demonstrates abnormal signal with a small amount of extension beneath the scalp .The histopathology and radiology correlation was perfect in all the two cases. [Figure 11 & 12].

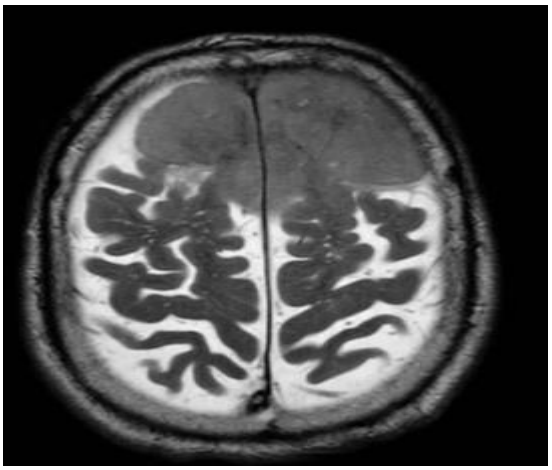

Figure 10: MRI with contrast demonstrate a very large bifrontal extraaxial mass which has a large dural base and enhances homogenously.

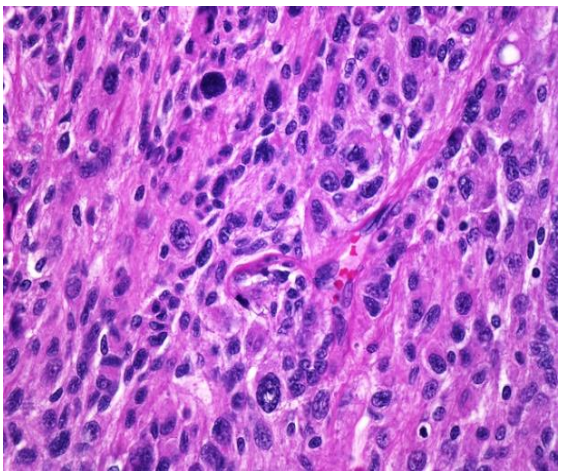

Figure 11: Section studied shows patternless sheet like growth, a large number of mitoses , increased cellularity, pleomorphism and anaplasia.

Metastasis: The most common sites of metastasis include the lung, pleura, liver and bone . Approximately one quarter of brain specimens that include brain parenchyma have brain invasion microscopically characterised by invasion of the cortical parenchyma by single cells or small groups of tumour cells , In such samples brain is seen as islands of gliotic neurophil trapped among solid tumour .In the presence of anaplastic meningioma , true brain invasion confirms the diagnosis of malignant meningioma.Brain invasion is a clear predictor of recurrence .The presence of brain invasion in benign- appearing tumours warrant careful follow up .

MRI scans were obtained at pre-defined intervals, every 6months for the first year and then yearly thereafter. The grade 1 tumours meningothelial meningioma, fibroblastic meningioma, transitional meningioma, angioblastic meningioma responded well to treatment. The atypical meningioma and

anaplastic meningioma did not respond to treatment. [Table 5]

Table 5: Final Outcomeofthe Study.

Tumour	Surgery Done	Cure rate	Follow up
Meningothelial meningioma	Seven cases underwent Simpson grade 1 resection and three cases underwent stereotactic radiosurgery as they were less than two centimetres in size.	100 %	Ten cases are attending follow up.
Fibroblastic meningioma	Three cases underwent Simpson grade 1 resection	100 %	Three cases reported for follow up .
Transitional meningioma	All five cases underwent Simpson grade 1 resection.	100 %	Five case reported for follow up.
Angiomatous meningioma	Two cases underwent Simpson grade 1 resection. One case underwent follow up stereotacticradiosurgery.	100 %	Two cases reported for follow up
Atypical meningioma	All three cases underwent Simpson grade 2 resection. One case underwent follow up stereotactic radiosurgery	-	No cases reported for follow up after one year .
Anaplastic meningioma	All two cases underwent Simpson grade 3 resection and one case underwent follow up stereotacticradiosurgery . One case died due to venous thromboembolism.	-	No case reported for follow up after six months.
Total	Twenty five cases underwent surgery. Seven cases underwent stereotactic radiosurgery .		Twenty cases turned for follow up.

DISCUSSION

Our study has similar findings with the literature including female predominance and age distribution.[19-26] One patient experienced VTE and died because of pulmonary embolism. Meningothelial andtransitional meningiomas were the most common pathological subtypes of meningiomas. Skull base and posterior fossa are surgically challenging localizations for meningiomas and microsurgical resection of these tumours is frequently associated with new onset of neurological impairment.[27] Based on the hypothesis, that the diffusion of water to and from the cells is highly dependent on the ratio of intracellular and extracellular space, DWI MRI Scan is used to differentiate the tumour grades.[28-30] High grade meningiomas are characterized by restriction of the water diffusion; depicting as hyperintensity on DWI. SpectroscopyMRI Scan provides molecular information with regard to meningiomas and potentially aid in biopsy planning. When analyzed all pathological subtypes, the poor prognosis was found in anaplastic meningiomas,followed by atypical meningiomas. Hypofractionated irradiation with the CyberKnife was demonstrated to be effective for treatment of meningiomas Stereotactic radiosurgery is a safe and effective treatment for benign intracranial meningiomas with or without surgical resection.

CONCLUSION

Group I meningioma demonstrated benign radiological, histopathological and clinical behaviour; group III demonstrated aggressive radiological, histopathological and clinical behaviour. Group II meningioma might be considered intermediate. Preoperative radiological classification can be used as a supplement to the histopathological grading. Convexity meningiomas are associated with recurrence, mortality and higher WHO 2007 grade. To achieve maximum benefit from surgery, convexity meningiomas should be totally resected. Adjuvant therapies like SRS can be beneficial for meningiomas located in the skull base as total resection of those meningiomas may cause functional loss and they tend to be more benign. The planned combination of microsurgery and GKRS extends the therapeutic spectrum in the treatment of meningiomas. The study provides the importance of other medical faculty the Surgeon , Radiologist and Oncologist to work as a team for a successful outcome . We correlated the Histopathological findings with Radiological findings .This resulted in perfect correlation between the Histopathology study and Radiology study.

REFERENCES

1. Ostrom QT, Gittleman H, Farah P, Ondracek A, Chen Y, Wolinsky Y, Stroup NE, Kruchko C, Barnholtz-Sloan JS: CBTRUS statistical report: Primary brain and central nervous system tumors diagnosed in the United States in 2006–2010. Neuro-oncology 15 Suppl 2: ii1– ii56, 2013 .
2. Perry A, Louis DL, Scheithauer BW, Budka H, von Deimling A: Meningiomas, in Louis DN, Ohgaki H, Wiestler OD, Cavenee WK, editors. (eds): WHO Classification of Tumours of the Central Nervous System. Lyon, France, IARC, 2007, pp 164– 172
3. Shibui S: Report of brain tumor registry of Japan (2001–2004). Neurologia Medico-Chirurgica 54: (suppl 1), 2014
4. Campbell BA, Jhamb A, Maguire JA, Toyota B, Ma R: Meningiomas in 2009: controversies and future challenges. Am J ClinOncol 32: 73– 85, 2009 .
5. Wiemels J, Wrensch M, Claus EBJ: Epidemiology and etiology of meningioma. Neurooncol 99: 307– 314, 2010 .
6. Whittle IR, Smith C, Navoo P, Collie D (2004) Meningiomas. Lancet 363:1535–43 .

7. Kuratsu J, Kochi M, Ushio Y (2000) Incidence and clinical features of asymptomatic meningiomas. J Neurosurg 92:766–770 .
8. Niiro M, Yatsushiro K, Nakamura K, Kawahara Y, Kuratsu J (2000) Natural history of elderly patients with asymptomatic meningiomas. J NeurolNeurosurg Psychiatry 68:25–28 .
9. Osawa T, Tosaka M, Nagaishi M, Yoshimoto YJ: Factors affecting peritumoral brain edema in meningioma: special histological subtypes with prominently extensive edema. Neurooncol 111: 49– 57, 2013 .
10. Tirakotai W, Mennel HD, Celik I, Hellwig D, Bertalanffy H, Riegel T: Secretory meningioma: immunohistochemical findings and evaluation of mast cell infiltration. Neurosurg Rev 29: 41– 48, 2006 .
11. Lusis EA, Scheithauer BW, Yachnis AT, Fischer BR, Chicoine MR, Paulus W, Perry A: Meningiomas in pregnancy: a clinicopathologic study of 17 cases. Neurosurgery 71: 951– 961, 2012 .
12. Shao C, Bai LP, Qi ZY, Hui GZ, Wang Z: Overweight, obesity and meningioma risk: a meta-analysis. PLoS ONE 9: e90167, 2014 .
13. Smith MJ, Higgs JE, Bowers NL, Halliday D, Paterson J, Gillespie J, Huson SM, Freeman SR, Lloyd S, Rutherford SA, King AT, Wallace AJ, Ramsden RT, Evans DG: Cranial meningiomas in 411 neurofibromatosis type 2 (NF2) patients with proven gene mutations: clear positional effect of mutations, but absence of female severity effect on age at onset. J Med Genet 48: 261– 265, 2011 .
14. Louis DNOH, Wiestler OD, Cavenee WK. WHO Classification of tumours of the central nervous system. Lyon: IARC Press; 2007.
15. Aghi MK, Carter BS, Cosgrove GR, Ojemann RG, Amin-Hanjani S, Martuza RL, et al. Long-term recurrence rates of atypical meningiomas after gross total resection with or without postoperative adjuvant radiation. Neurosurgery. 2009;64.
16. Nakasu S, Fukami T, Jito J, Nozaki K. Recurrence and regrowth of benign meningiomas. Brain TumorPathol. 2009;26(2):69–72.
17. Hasseleid BF, Meling TR, Ronning P, Scheie D, Helseth E. Surgery for convexity meningioma: Simpson Grade I resection as the goal: clinical article. Journal of neurosurgery. 2012;117(6) .
18. Kaplan RD, Coons S, Drayer BP, Bird CR, Johnson PC. MR characteristics of meningioma subtypes at 1.5 tesla. Journal of computer assisted tomography. 1992;16(3):366–71.
19. Cea-Soriano L, Wallander MA, Garcia RL: Epidemiology of meningioma in the United Kingdom. Neuroepidemiology 39:27-34, 2012
20. Dobes M, Khurana VG, Shadbolt B, Jain S, Smith SF, Smee R, Dexter M, Cook R: Increasing incidence of glioblastoma multiforme and meningioma, and decreasing incidence of Schwannoma (2000–2008): Findings of a multicenter Australian study. SurgNeurolInt 2: 176, 2011
21. Dolecek TA, Propp JM, Stroup NE, Kruchko C: CBTRUS statistical report: Primary brain and central nervous system tumors diagnosed in the United States in 2005–2009. Neurooncology 14: v1-v49, 2012
22. Hoefnagel D, Kwee LE, van Putten EHP, Kros JM, Dirven CMF, Dammers R: The incidence of postoperative thromboembolic complications following surgical resection of intracranial meningioma. A retrospective study of a large single center
23. patient cohort. ClinNeurolNeurosurg 123: 150-154, 2014
24. Ostrom QT, Gittleman H, Farah P, Ondracek A, Chen Y, Wolinsky Y, Stroup NE, Kruchko C, Barnholtz-Sloan JS: CBTRUS statistical report: Primary brain and central nervous system tumors diagnosed in the United States in 2006-2010. Neuro-Oncology 15 Suppl 2: ii1-ii56, 2013
25. Shibui S: The present status and trend of brain tumours based on the data of the Brain Tumor Registry of Japan. Brain Nerve 64: 286-290, 2012
26. Wang DJ, Xie Q, Gong Y, Mao Y, Wang Y, Cheng HX, Zhong P, Che XM, Jiang CC, Huang FP, Zheng K, Li SQ, Bao WM, Yang BJ, Wu JS, Xie LQ, Zheng MZ, Tang HL, Zhu HD, Chen XC, Zhou LF: Histopathological classification and location of consecutively operated meningiomas at a single institution in China from 2001 to 2010. Chin Med J 126(3):488–493, 2013
27. Zouaoui S, Rigau V, Mathieu-Daude H, Darlix A, Bessaoud F, Fabbro-Peray P, Bauchet F, Kerr C, Fabbro M, FigarellaBranger D, Taillandier L, Duffau H, Trettare B, Bauchet L: French brain tumor database: General results on 40,000 cases, main current applications and future prospects.Neurochirurgie 58:4-13, 2012 .
28. Arnautovic KI, Al Mefty O, Husain M: Ventral foramen magnum meningiomas. J Neurosurgery 92:71–80, 2000
29. Perry A LD, Scheithauer BW, Budka H, von Diemling A. Meningiomas. In: Louis DN OH, Wiestler OD, editor. World Health Organization Classification of Tumours of the Central Nervous System. 4 ed. Lyon: IARC; 2007. p. 164–72.
30. Ohba S, Kobayashi M, Horiguchi T, Onozuka S, Yoshida K, Ohira T, et al. Long-term surgical outcome and biological prognostic factors in patients with skull base meningiomas. Journal of neurosurgery. 2011;114(5):1278–87. Epub 2010/12/21. doi: 10.3171/2010.11.jns10701.
31. Santelli L, Ramondo G, Della Puppa A, Ermani M, Scienza R, d'Avella D, et al. Diffusion-weighted imaging does not predict histological grading in meningiomas. ActaNeurochir (Wien). 2010;152(8).

How to cite this article: Kannan P, Krishnaveni AG, Anandan H. A Radiology - Pathological Correlation Of Intracranial Meningioma in a Tertiary Care Hospital-A Retrospective Study. Ann. Int. Med. Den. Res. 2017; 3(4):PT74-PT82.

Source of Support: Nil, **Conflict of Interest:** None declared